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Climatology and Trends in Extratropical Cyclones Over the Past 100 Years

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Abstract: Extratropical cyclones (ETC) are the major feature of mid-latitude weather during the colder times of the year and are responsible for many of the extreme weather types experienced at mid-latitudes. A major uncertainty in climate change is how extratropical cyclones have changed both globally and regionally over the past 100+ years. One of the 12 recommendations (4.4) for improving our understanding of climate extremes contained in the Climate Change Science Program (CCSP 2008) Synthesis and Assessment Product 3.3: Weather and Climate Extremes in a Changing Climate is to use reanalysis products from new efforts currently underway to study global and regional changes in extratropical cyclones. Past efforts to examine changes in strong extratropical cyclones have relied on past reanalysis efforts that are restricted to the period since 1948 or later. Furthermore, older reanalysis data sets are not homogeneous due to issues such as the introduction of satellite data in the 1970s. A current reanalysis effort that can help resolve these issues utilizes only surface pressure for input and begins in the early 1890s (Compo, et al. 2006). This project, NOAA Historical Reanalysis, is being run by the NOAA Earth System Research Laboratory using the Climate Forecast System (CFS) developed at NOAA National Centers for Environmental Prediction (NCEP).

In this project, we propose to construct a global climatology of extra-tropical cyclones utilizing the Historical Reanalysis data set currently under construction set for completion in mid-2009 (G. Compo, personal communication). Once the climatology has been established, the Historical Reanalysis will be used to examine temporal and spatial variability and changes in storms, both number and intensity. An online database of cyclone tracks and associated products will be created.

Overarching goals in the analysis are to identify latitudinal shifts over time in the mean storm track, to determine whether there are longitudinal variations in such shifts, and to investigate mean changes and spatial variability in storm number and intensity. Within these overarching goals, we propose to investigate whether there were changes in storm tracks and intensities coincident with notable global and regional climate variations, including the rapid global warming in the early part of the 20th Century following by cooling during the middle of the 20th Century, the wetness in the western U.S. during the early part of the 20th Century, and the drought during the Dust Bowl era of the 1930s. We will also examine whether there were changes over time in the relationships between storm tracks and climate modes of variability, particularly ENSO.